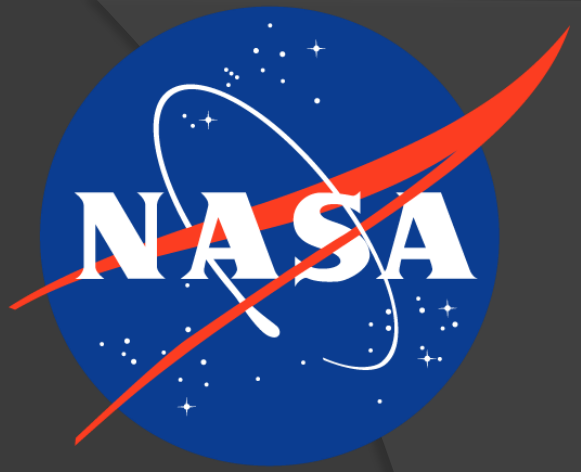
COMPONENTS OF NASA'S DATA ACQUISITION SYSTEM

Fall Internship, 2015

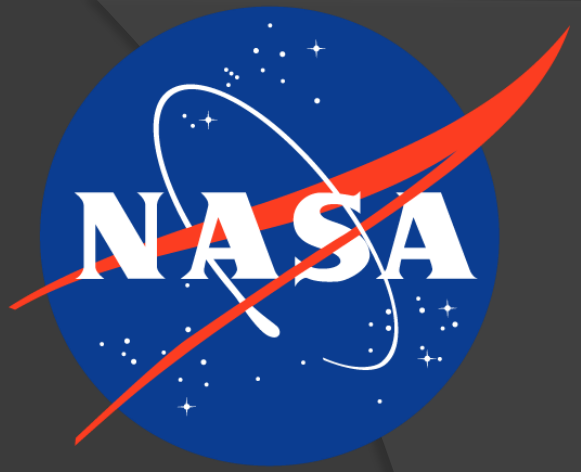
Melanie Schmocker

Overview



- Context
  - NDAS
- NOSS
  - Nodes
  - Form Validation
- NCAL
  - Calibration Report
- Other
- Questions

Overview



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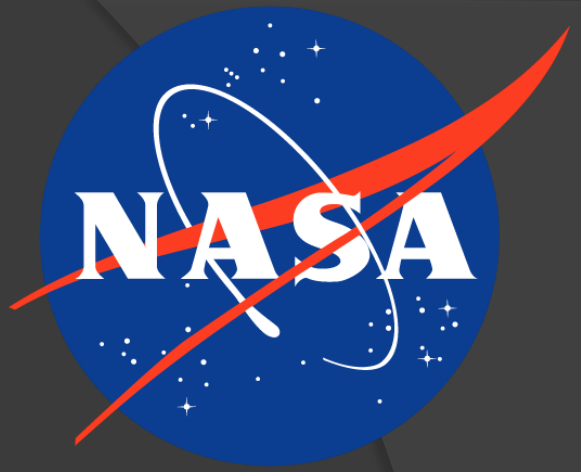

- Stennis Space Center

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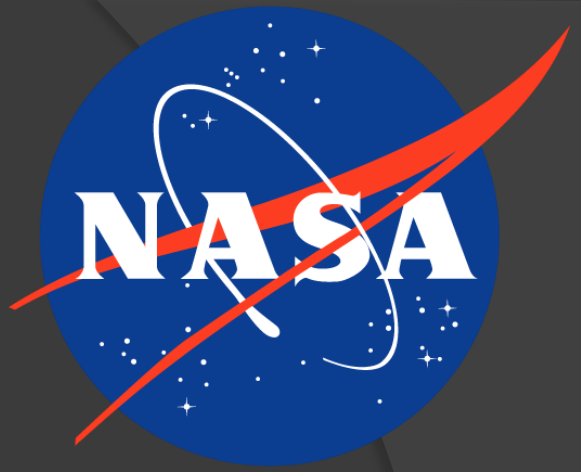

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  - Test rocket engines

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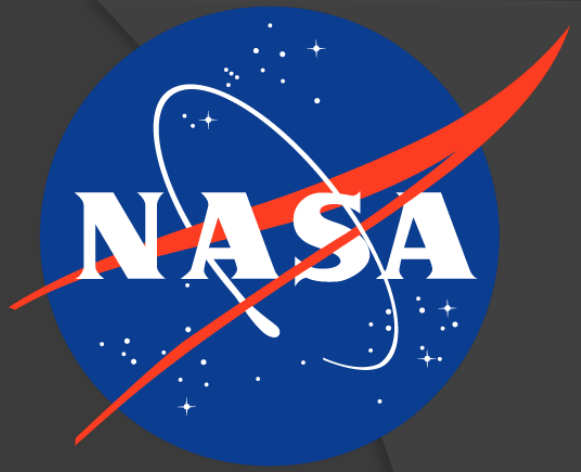
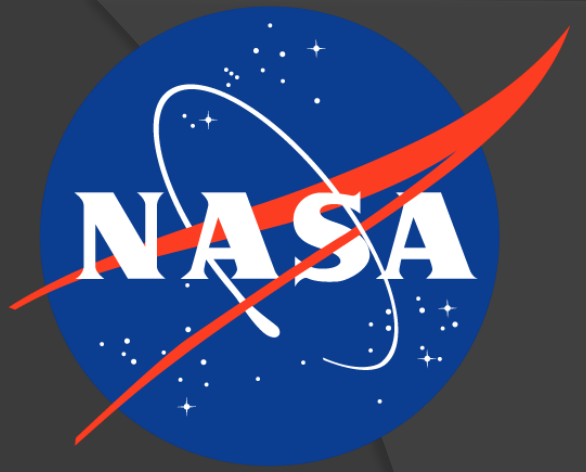


- Stennis Space Center
  - Test rocket engines
- NDAS – NASA's Data Acquisition System

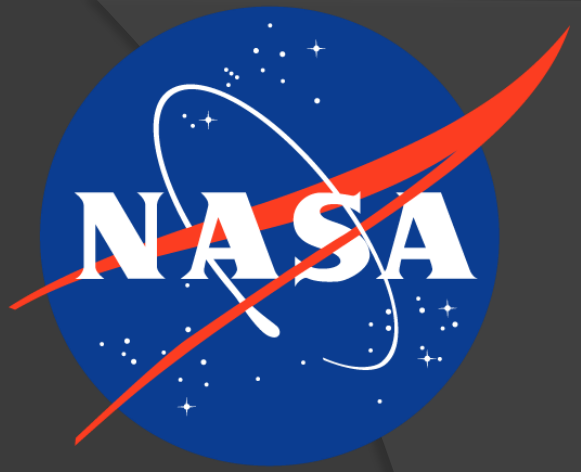
Context



- Stennis Space Center
  - Test rocket engines
- NDAS – NASA's Data Acquisition System which can:
  - Calibrate (NCAL)
  - Record (NLOG)
  - Display (NDIS)
  - Export (NGATE)

  and otherwise process data from tests

Overview



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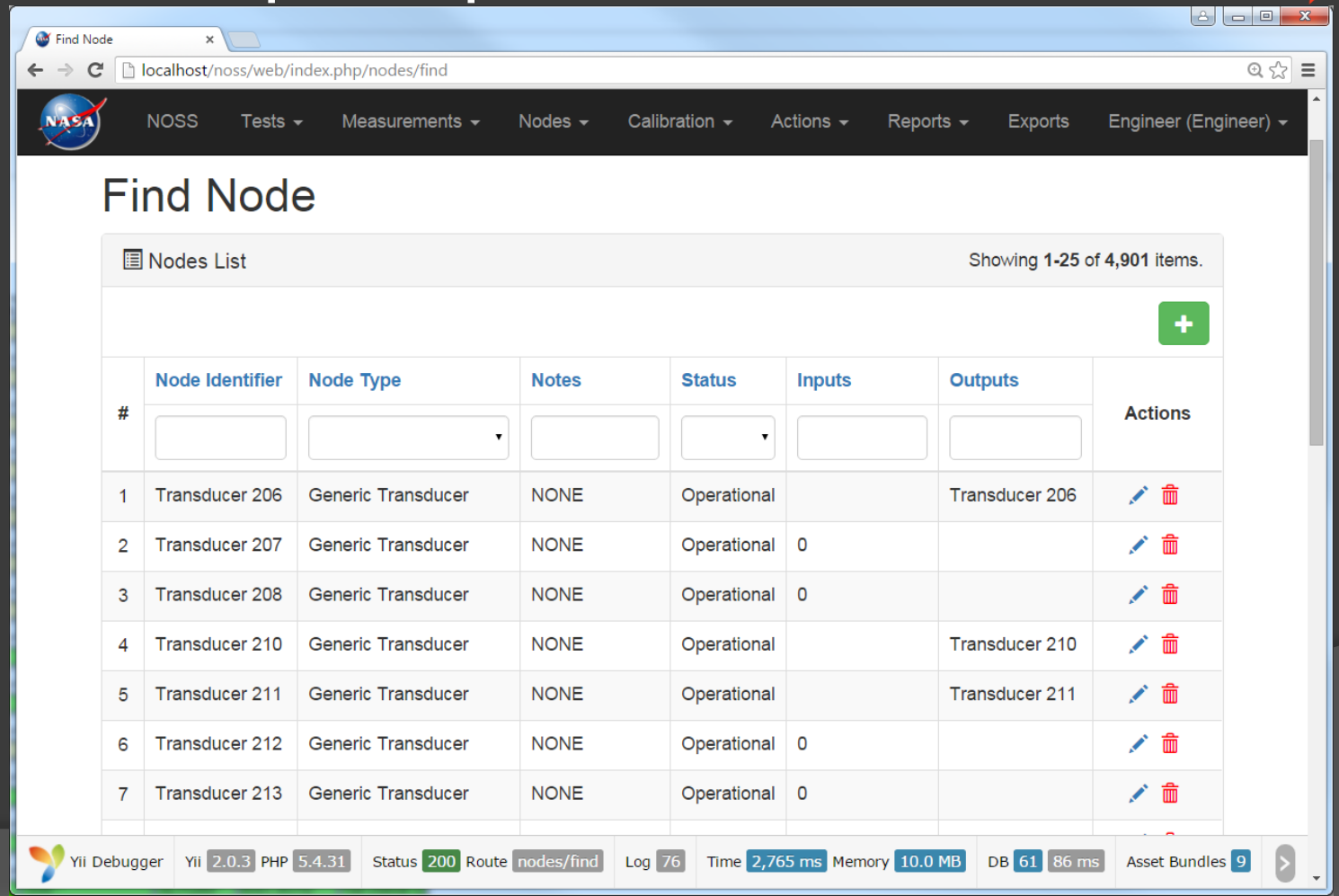
NOSS Database

- NASA's One-Stop Shop



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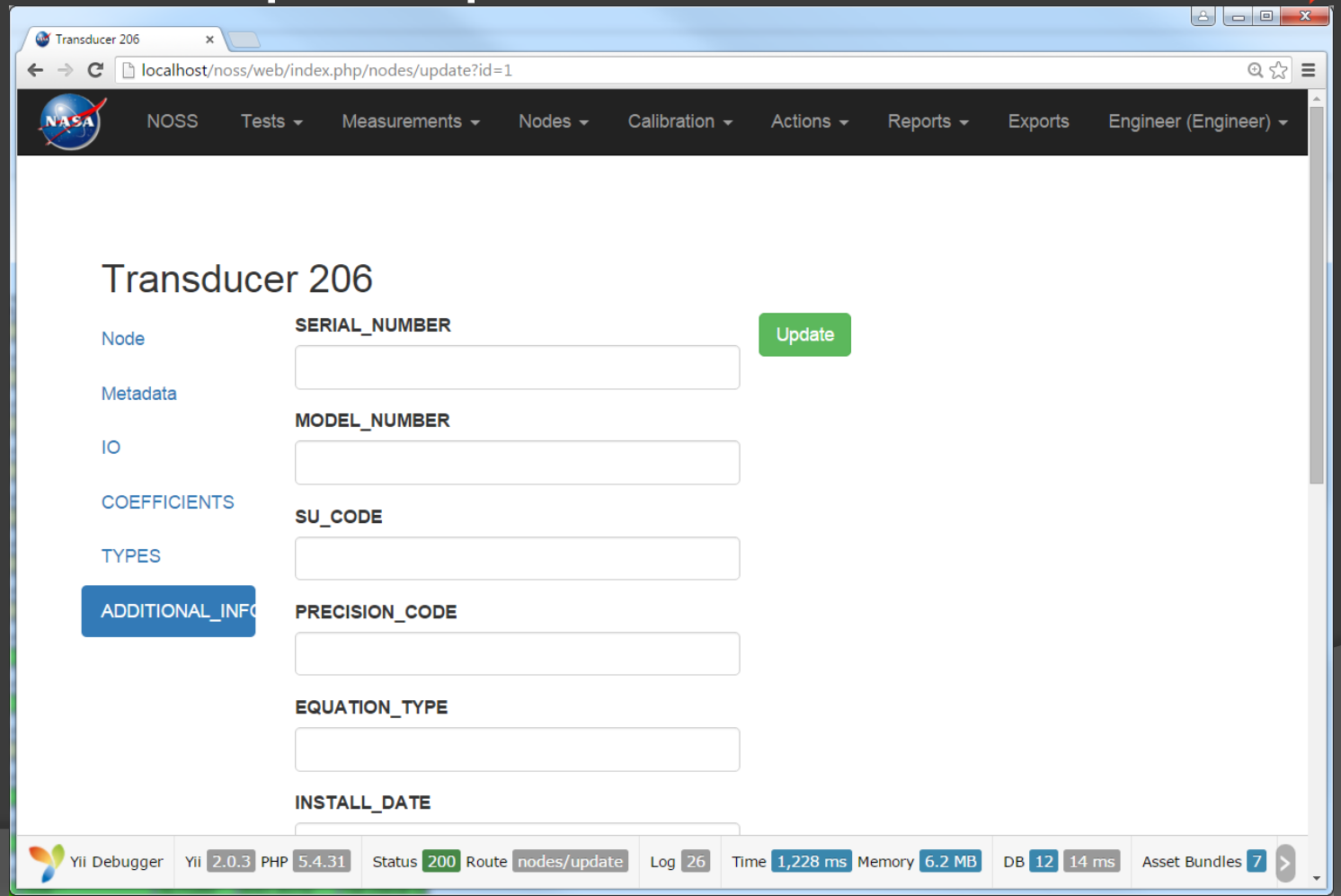
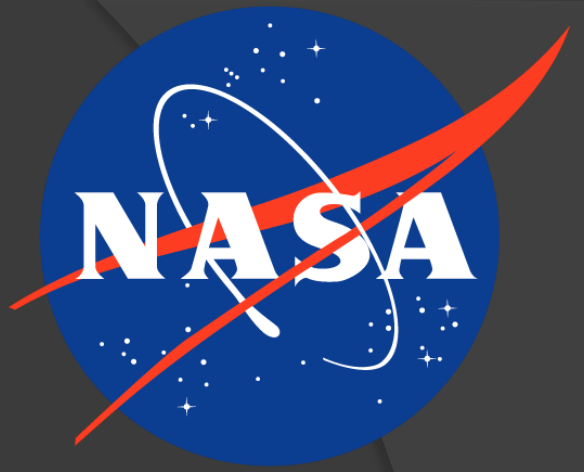
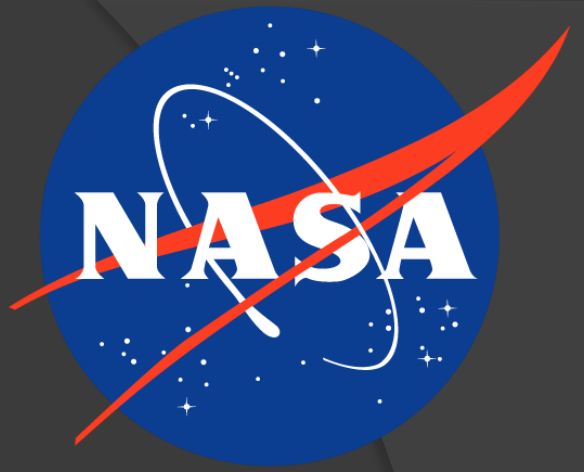


Nodes and Measurements



- Each Node represents a piece of hardware on the test stand

Nodes and Measurements



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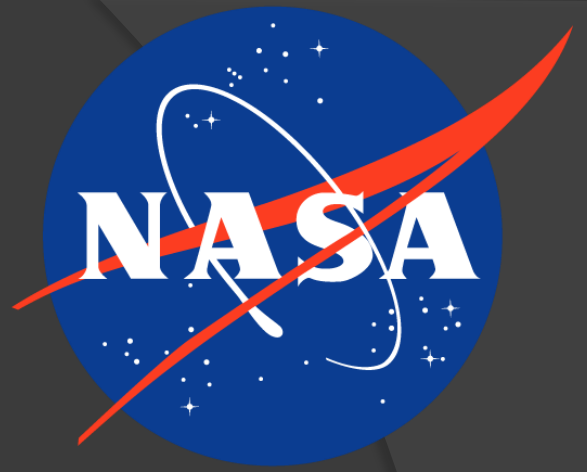
  - Sensors
  - Filters
  - Digitizers

Nodes and Measurements



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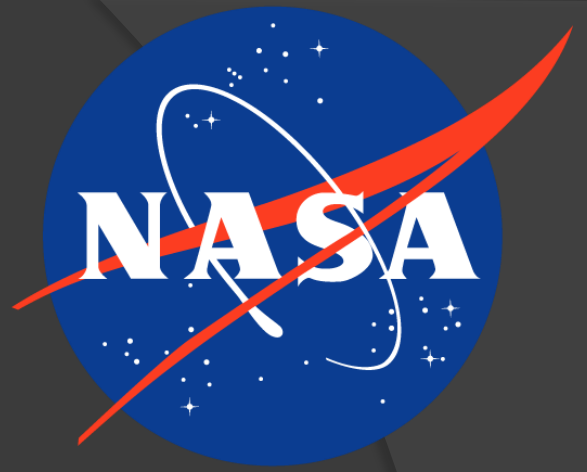
Nodes and Measurements



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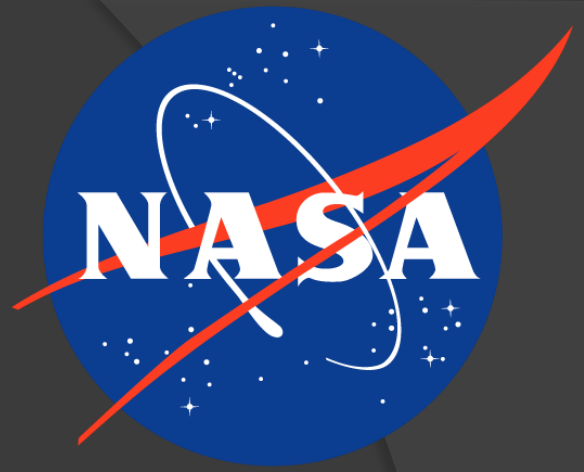
Nodes and Measurements



- Each Node represents a piece of hardware on the test stand
  - Sensors
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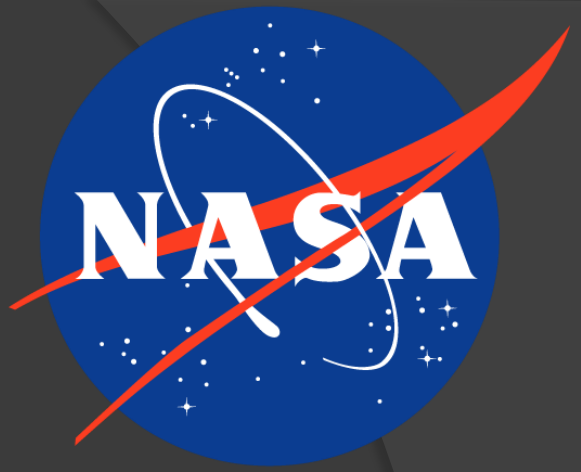
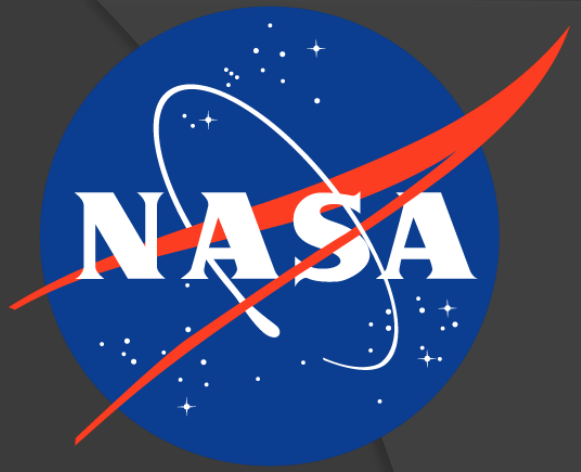
- Measurements are collections of Nodes
  - Represent Nodes that are physically connected
  - Enable intuitive interpretation of data

Adding Nodes



- How to handle new types of hardware?

Adding Nodes



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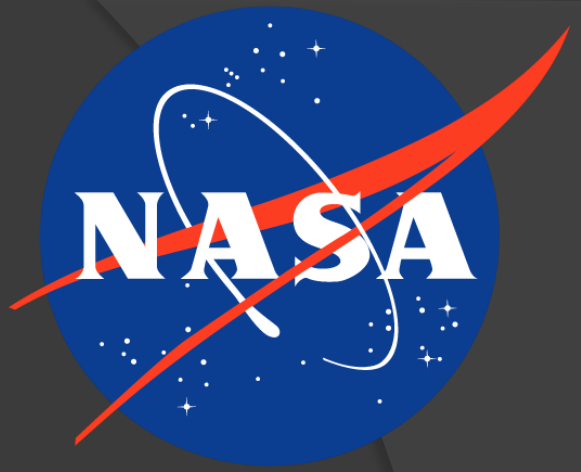

- How to handle new types of hardware?
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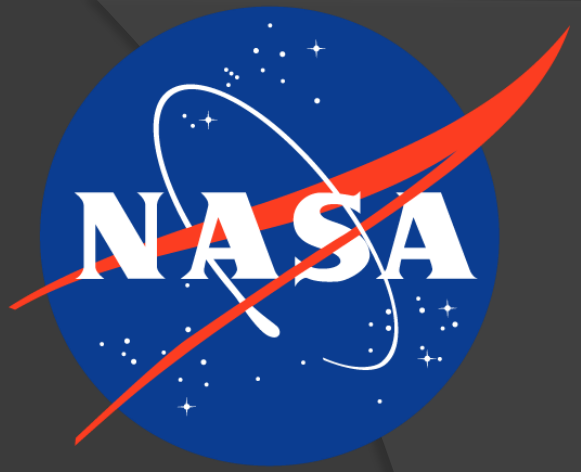

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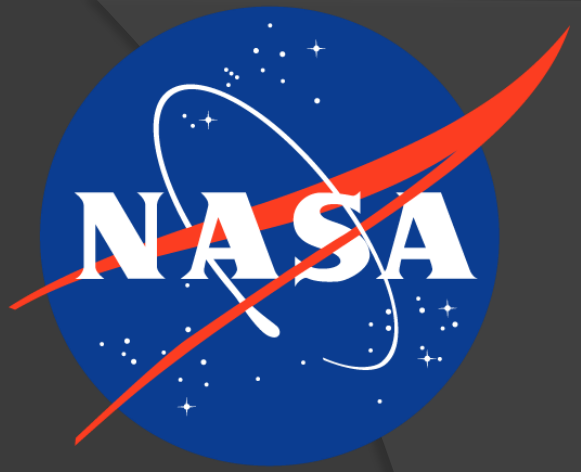

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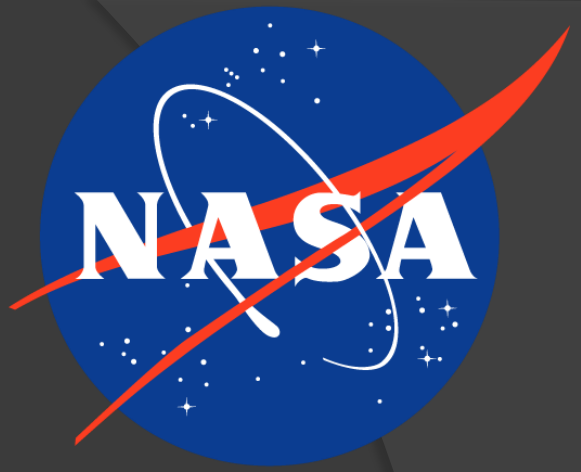

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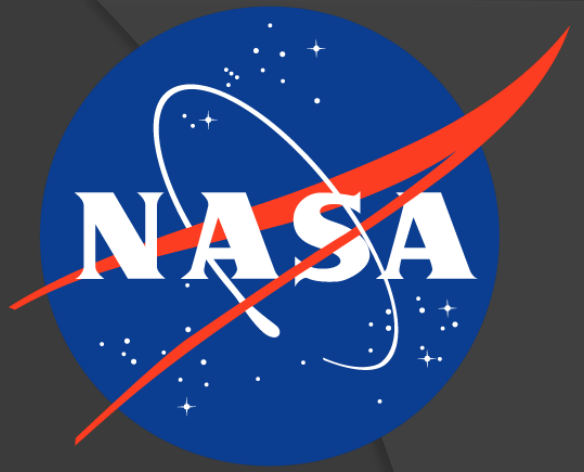

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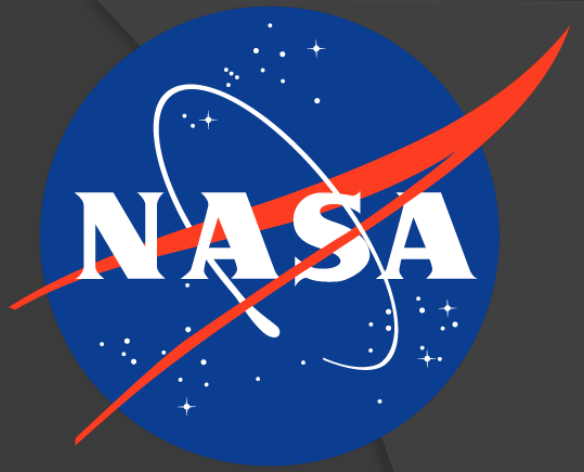

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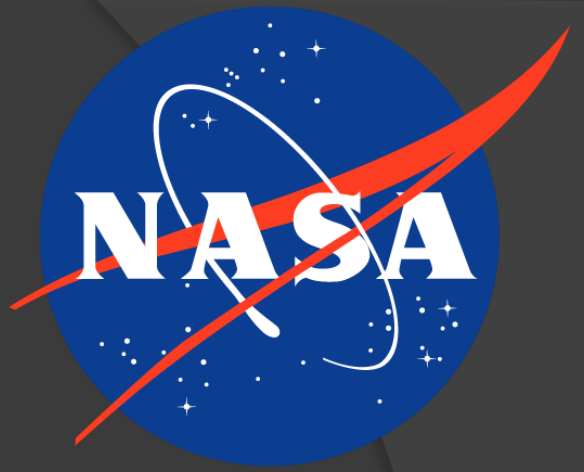

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Node Form Updates

- XSD format

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- XSD format
  - XML Schema Definition

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- XSD format
  - XML Schema Definition

NIRDTableMapping.xml | Generic_Transducer.xsd

```
1  <xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" attributeFormDefault=
   "unqualified" elementFormDefault="qualified">
2
3    <xs:element name="GENERIC_TRANSDUCER" type="GenericTransducerType"/>
4
5    <xs:complexType name="IOType">
6      <xs:sequence>
7        <xs:element type="xs:string" name="OUTPUT" maxOccurs="1" minOccurs="1"
8      </xs:sequence>
9    </xs:complexType>
10
11   <xs:complexType name="CoefficientType">
12     <xs:sequence>
13       <xs:element type="xs:float" name="ACTUAL_COEFFICIENT_A0"/>
14       <xs:element type="xs:float" name="ACTUAL_COEFFICIENT_A1"/>
15       <xs:element type="xs:float" name="ACTUAL_COEFFICIENT_A2"/>
16       <xs:element type="xs:float" name="ACTUAL_COEFFICIENT_A3"/>
17       <xs:element type="xs:float" name="ACTUAL_COEFFICIENT_A4"/>
18       <xs:element type="xs:float" name="ACTUAL_COEFFICIENT_A5"/>
19       <xs:element type="xs:float" name="ACTUAL_COEFFICIENT_A6"/>
20       <xs:element type="xs:float" name="ACTUAL_COEFFICIENT_A7"/>
21     </xs:sequence>
22   </xs:complexType>
23
24   <xs:complexType name="TransducerTypes">
25     <xs:sequence>
26       <xs:element type="xs:string" name="TRANSDUCER_TYPE"/>
27       <xs:element type="xs:float" name="RTP"/>
28       <xs:element type="xs:float" name="RTD_MC_T1"/>
29       <xs:element type="xs:float" name="RTD_MC_T2"/>
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Node Form Updates

- XSD format
  - Before me: minimal validations

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19       <xs:element type="xs:float" name="ACTUAL_COEFFICIENT_A6"/>
20       <xs:element type="xs:float" name="ACTUAL_COEFFICIENT_A7"/>
21     </xs:sequence>
22   </xs:complexType>
23
24   <xs:complexType name="TransducerTypes">
25     <xs:sequence>
26       <xs:element type="xs:string" name="TRANSDUCER_TYPE"/>
27       <xs:element type="xs:float" name="RTP"/>
28       <xs:element type="xs:float" name="RTD_MC_T1"/>
29       <xs:element type="xs:float" name="RTD_MC_T2"/>
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Node Form Updates

- XSD format
  - Before me: minimal validations
  - My tasks
    - Update XPath references

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Node Form Updates

- XSD format
  - Before me: minimal validation done
  - My tasks
    - Update XPath references
    - Enforce all XSD validations in browser form

demonstration.xsd

```
44  <xs:complexType name="BaseDemoType">
45
46      <xs:sequence>
47          <xs:element name="NUMBERS" type="numberType"/>
48          <xs:element name="STRINGS" type="stringType"/>
49          <xs:element name="OTHERS" type="otherType"/>
50      </xs:sequence>
51  </xs:complexType>
52
53  <xs:complexType name="numberType">
54
55      <xs:sequence>
56
57          <xs:element name="INCLUSIVE_BOUNDARIES_0_TO_100">
58              <xs:simpleType>
59                  <xs:restriction base="xs:integer">
60                      <!-- restricts acceptable inputs to integers -->
61                      <xs:minInclusive value="0"/>
62                      <xs:maxInclusive value="100"/>
63                      <!-- Allows values between min and max, including the boundaries
64                  </xs:restriction>
65              </xs:simpleType>
66          </xs:element>
67
68          <xs:element name="EXCLUSIVE_BOUNDARIES_0_TO_100">
69              <xs:simpleType>
70                  <xs:restriction base="xs:float">
71                      <xs:minExclusive value="0"/>
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Node Form Updates

- XSD format
  - Restrictions
  - Extensions

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Node Form Updates

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    - Limit values stored
  - Extensions

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- XSD format
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  - Extensions
    - Add attributes to XML

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  - Extensions
    - Add attributes to XML
- Validations

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Validations

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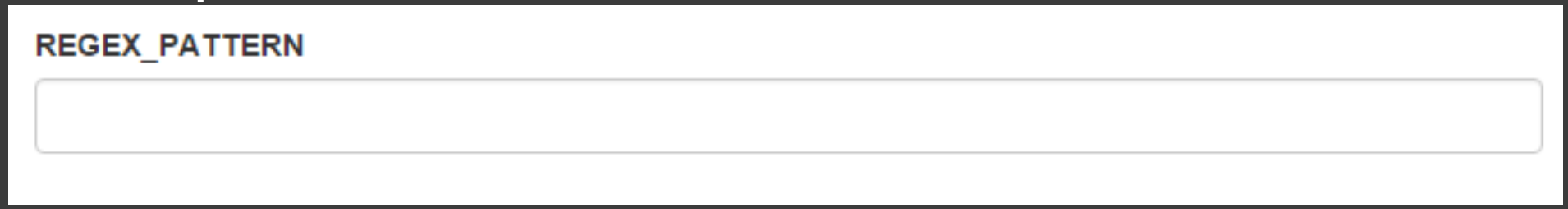
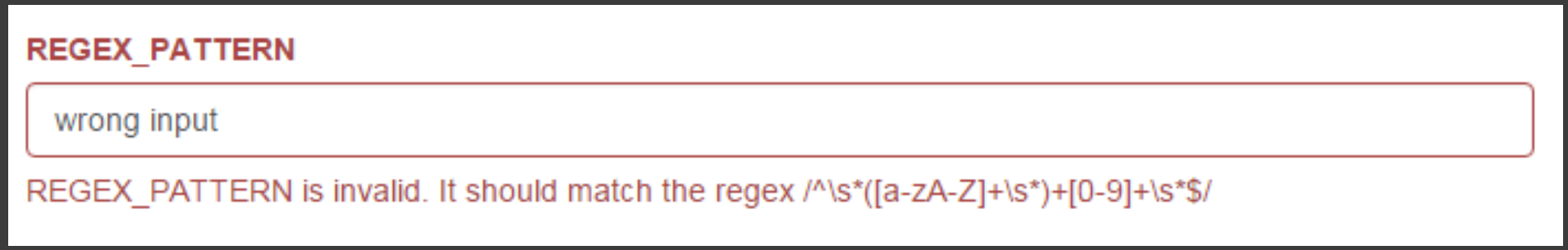


- Invalid input



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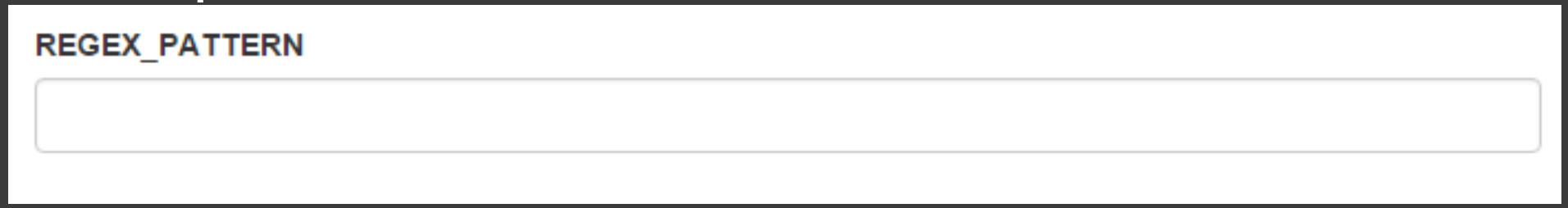
Validations

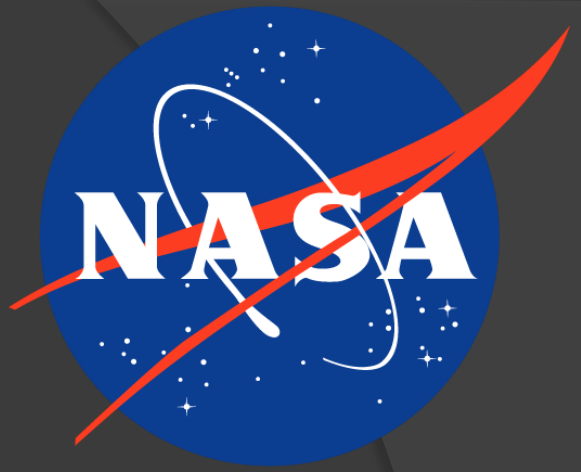
- No input



- Invalid input

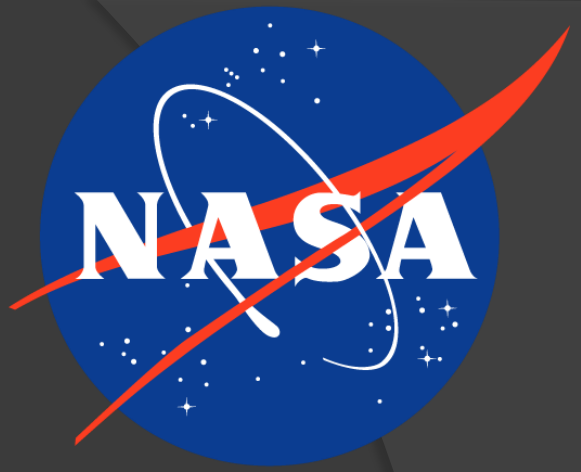
- Valid input

Overview



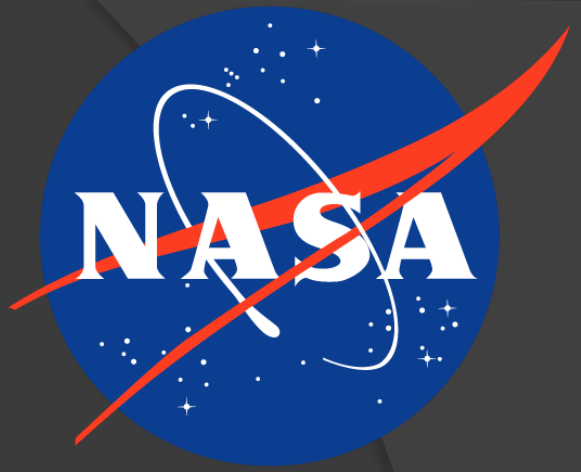
- Context
  - NDAS
- NOSS
  - Nodes
  - Form Validation
- NCAL
  - Calibration Report
- Other
- Questions

NCAL



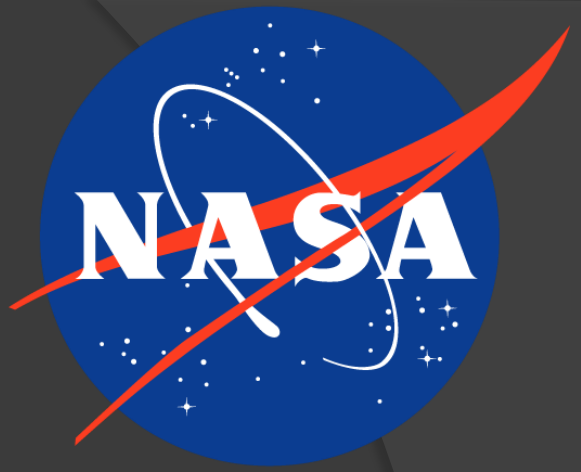
- Calibrates Measurements
  - May also compare against a trusted prior calibration

NCAL



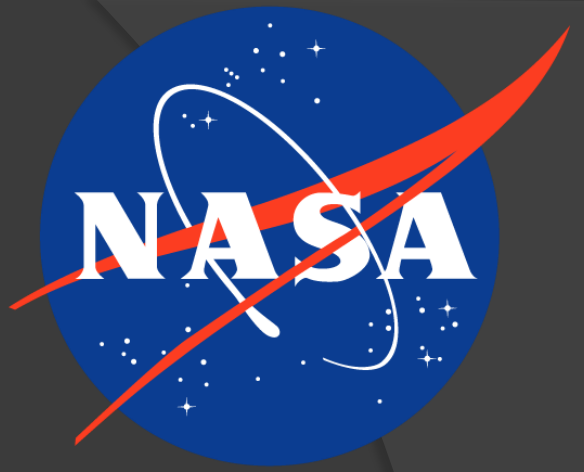
- Calibrates Measurements
  - May also compare against a trusted prior calibration
- Produces a Calibration Report

NCAL



- Calibrates Measurements
  - May also compare against a trusted prior calibration
- Produces a Calibration Report
  - Sensors calibrated at different points throughout the range of expected values

NCAL



- Calibrates Measurements
  - May also compare against a trusted prior calibration
- Produces a Calibration Report
  - Sensors calibrated at different points throughout the range of expected values
  - Report is HTML but must also be printable

Calibration Report Updates

- Prior format

NDAS Daily Cal Report

TEST STAND	
OPERATOR	
CAL DATE	
DATA BASE MDID	
REF CAL DATE	
TEST NUMBER	

This page was created on Thu Nov 12 2015 at 16:10:59

CAL FILE	AMP	MEASUREMENT ID	PASS	PREAMB COUNTS	0 CAL	80 CAL	POSTAMB COUNTS	NCAL C0	NCAL C1	Description
CURRENT	0	CUI-000	0	15	17	23437	20	-0.060581	11.262992	Test Channel 0
ANCILLARY	1	PSIG	0	5	4	5	4	23420	0	
CURRENT	1	CUI-001	0	32767	32767	32767	32767	0.000000	1.000000	Test Channel 1
ANCILLARY	2	DegR	0	0	0	0	0	0	0	
CURRENT	2	CUI-002	0	8319	8404	8392	8321	886.795410	-344.591949	Test Channel 2
ANCILLARY	A	DegR	0	195	187	154	159	-11	0	
CURRENT	3	CUI-003	0	2070	2037	1989	2085	55.478905	-84.392159	Test Channel 3
ANCILLARY	B	PSIG	0	129	61	117	75	-47	0	
CURRENT	4	CUI-004	0	18783	18855	18801	18988	426.630859	-73.618820	Test Channel 4
ANCILLARY	A	PSIA	0	176	198	290	279	-54	0	
CURRENT	5	CUI-005	0	11504	11554	11517	11548	393.379669	-110.711685	Test Channel 5
ANCILLARY	B	TEST	0	137	102	104	120	-36	0	
CURRENT	6	CUI-006	0	22042	21889	22003	21919	-234.164505	35.502769	Test Channel 6
ANCILLARY	A	DegR	0	158	228	177	170	113	0	
CURRENT	7	CUI-007	1	10383	-64	-64	10295	-332.067383	-16958.101562	Test Channel 7
ANCILLARY	B	DegR	0	98	4	5	118	0	0	
CURRENT	8	CUI-008	1	-32768	59	60	-32768	-82.248108	4518.101074	Test Channel 8
ANCILLARY	A	DegR	0	0	5	4	0	0	0	
CURRENT	9	CUI-009	0	602	640	-1434	645	3.381169	-1.948625	Test Channel 9
ANCILLARY	B	DegR	0	91	120	142	103	-2075	0	
CURRENT	10	CUI-010	1	-8442	0	0	-8436	-1.160327	15439.156250	Test Channel 10
ANCILLARY	A	DegR	0	309	5	4	195	0	0	
CURRENT	11	CUI-011	1	9369	-1	-5	9344	-7.753644	-12366.498047	Test Channel 11
ANCILLARY	B	DegR	0	67	5	5	86	0	0	
CURRENT	12	CUI-012	1	-5154	1	1	-5049	-42.772984	96401.343750	Test Channel 12
ANCILLARY	A	DegR	0	240	4	4	199	0	0	

Calibration Report Updates

- Prior format
- Refactor HTML

NDAS Daily Cal Report

TEST STAND	
OPERATOR	
CAL DATE	
DATA BASE MDID	
REF CAL DATE	
TEST NUMBER	

This page was created on Thu Nov 12 2015 at 16:10:59

CAL FILE	AMP	MEASUREMENT ID	PASS	PREAMB COUNTS	0 CAL	80 CAL	POSTAMB COUNTS	NCAL C0	NCAL C1	Description
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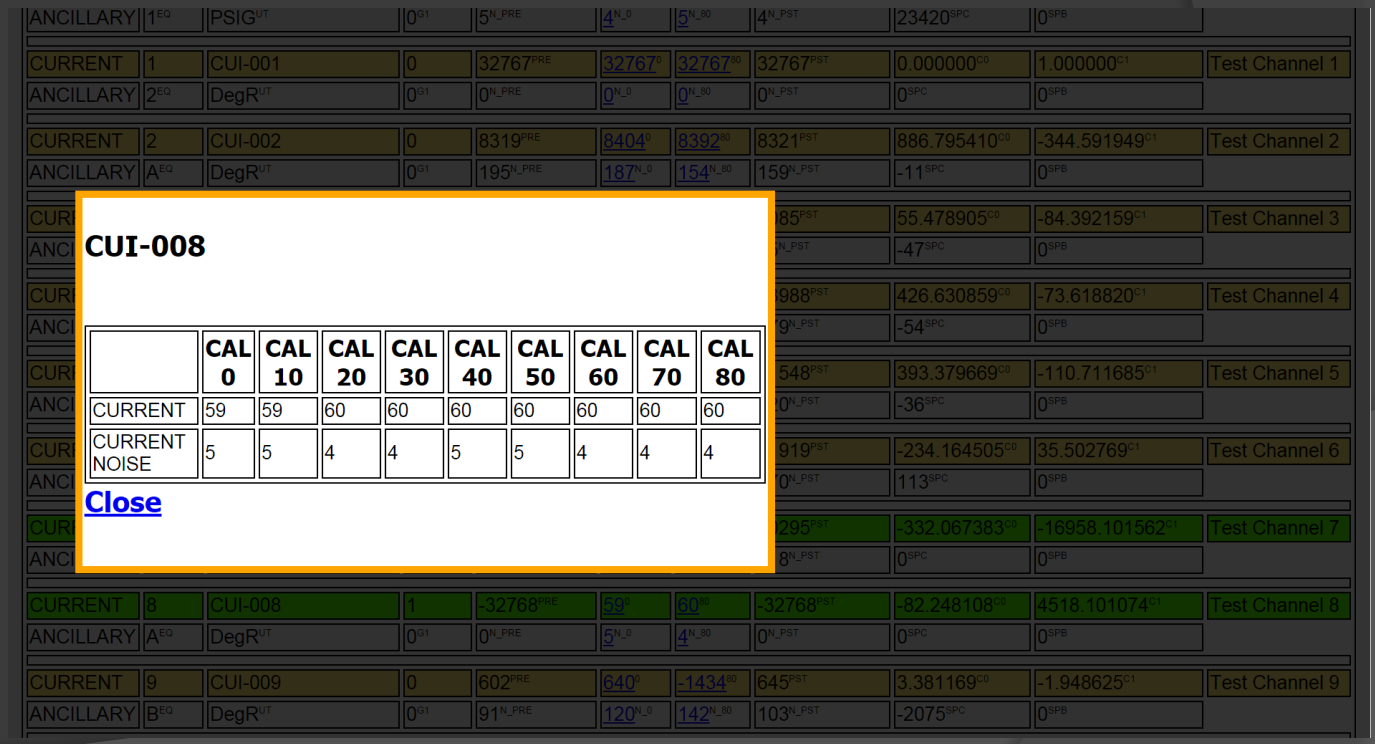
ANCILLARY	1	PSIG	0	5	4	5	4	23420	0	
CURRENT	1	CUI-001	0	32767	32767	32767	32767	0.000000	1.000000	Test Channel 1
ANCILLARY	2	DegR	0	0	0	0	0	0	0	
CURRENT	2	CUI-002	0	8319	8404	8392	8321	886.795410	-344.591949	Test Channel 2
ANCILLARY	A	DegR	0	195	187	154	159	-11	0	
CURRENT	3	CUI-003	0	2070	2037	1989	2085	55.478905	-84.392159	Test Channel 3
ANCILLARY	B	PSIG	0	129	61	117	75	-47	0	
CURRENT	4	CUI-004	0	18783	18855	18801	18988	426.630859	-73.618820	Test Channel 4
ANCILLARY	A	PSIA	0	176	198	290	279	-54	0	
CURRENT	5	CUI-005	0	11504	11554	11517	11548	393.379669	-110.711685	Test Channel 5
ANCILLARY	B	TEST	0	137	102	104	120	-36	0	
CURRENT	6	CUI-006	0	22042	21889	22003	21919	-234.164505	35.502769	Test Channel 6
ANCILLARY	A	DegR	0	158	228	177	170	113	0	
CURRENT	7	CUI-007	1	10383	-64	-64	10295	-332.067383	-16958.101562	Test Channel 7
ANCILLARY	B	DegR	0	98	4	5	118	0	0	
CURRENT	8	CUI-008	1	-32768	59	60	-32768	-82.248108	4518.101074	Test Channel 8
ANCILLARY	A	DegR	0	0	5	4	0	0	0	
CURRENT	9	CUI-009	0	602	640	-1434	645	3.381169	-1.948625	Test Channel 9
ANCILLARY	B	DegR	0	91	120	142	103	-2075	0	
CURRENT	10	CUI-010	1	-8442	0	0	-8436	-1.160327	15439.156250	Test Channel 10
ANCILLARY	A	DegR	0	309	5	4	195	0	0	
CURRENT	11	CUI-011	1	9369	-1	-5	9344	-7.753644	-12366.498047	Test Channel 11
ANCILLARY	B	DegR	0	67	5	5	86	0	0	
CURRENT	12	CUI-012	1	-5154	1	1	-5049	-42.772984	96401.343750	Test Channel 12
ANCILLARY	A	DegR	0	240	4	4	199	0	0	

Calibration Report Updates

- Prior format
- Refactor HTML
- Add interactive data

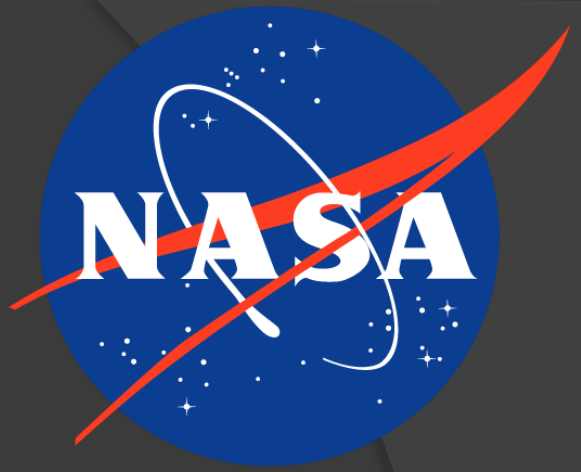


CUI-008

	CAL 0	CAL 10	CAL 20	CAL 30	CAL 40	CAL 50	CAL 60	CAL 70	CAL 80
CURRENT	59	59	60	60	60	60	60	60	60
CURRENT NOISE	5	5	4	4	5	5	4	4	4

Close

Overview



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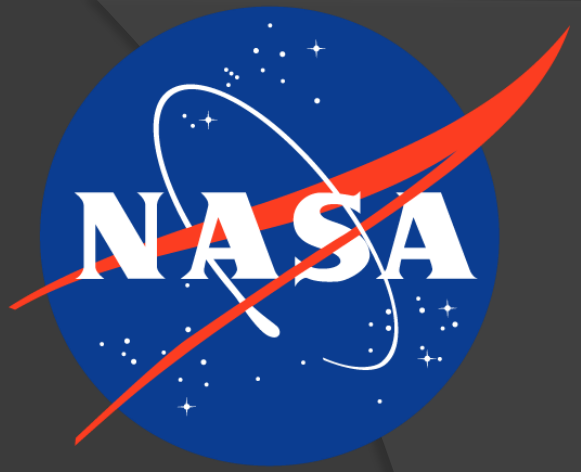
Overview



- Context
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Thank You